U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF THE ORANGEBURG AREA, SOUTH CAROLINA.

BY

FRANK BENNETT AND A. M. GRIFFEN.

[Advance Sheets—Field Operations of the Bureau of Soils, 1904.]

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

CONTENTS

ILLUSTRATIONS

TEXT FIGURE.

MAP.

SOIL SURVEY OF THE ORANGEBURG AREA, SOUTH CAROLINA.[a]

By FRANK BENNETT and A. M. GRIFFEN.

LOCATION AND BOUNDARIES OF THE AREA.

Orangeburg County lies in the south-central part of South Carolina, and has an extent of 1,345 square miles, being the second county in point of area in the State. The area mapped takes in all of that part of the county lying east of a line running north and south

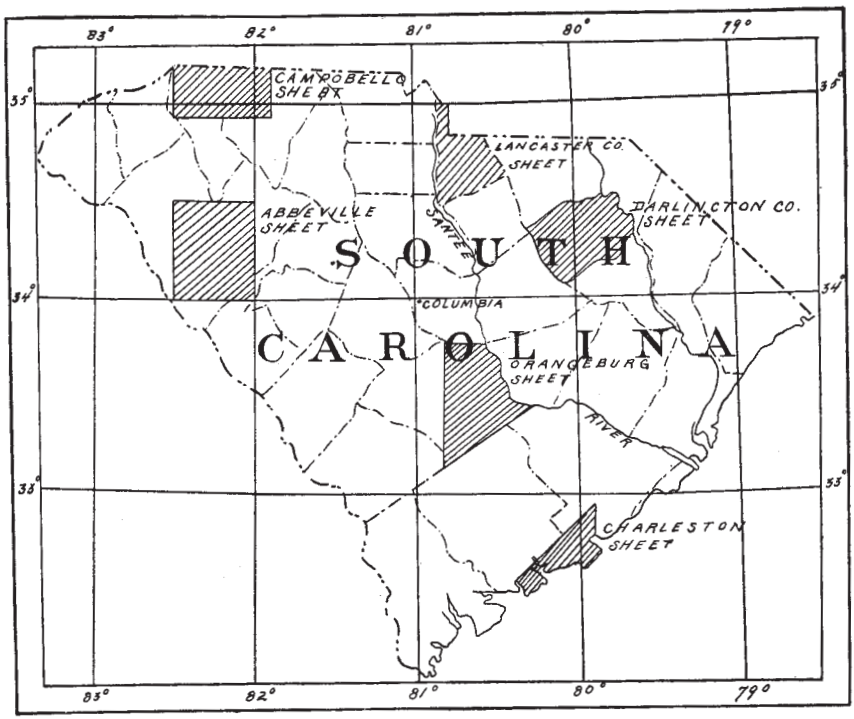

FIG. 1.—Sketch map showing location of the Orangeburg area, South Carolina.

through Orangeburg, and covers 454,080 acres, or about 710 square miles—a little over half of the entire county. The Congaree and Santee rivers form the northern and eastern boundaries of the area, respectively, while the Edisto River forms a small portion of the boundary on the southwest corner. Berkeley and Dorchester counties adjoin it on the south.

[a] This survey was begun in the season of 1903 by Messrs. Mangum and Griffen.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Shortly after 1700 a few white settlements had been made in the territory now included within Orangeburg County. In the year 1735 and in succeeding years a large number of Swiss and German immigrants came into the newly opened territory and founded a town upon the Edisto River, which they called Orangeburg, in honor of William, Prince of Orange. Subsequently this name was applied to a large section of surrounding country, of which the present county was a part. These early settlers were not adventurers, but tillers of the soil, seeking homes in a new country. A large number of the present white population are their direct descendants and possess their characteristic thrift and industry.

The first crops tried in this region were adapted to a colder climate, and hence proved almost a failure. The great pine forest that ranged on every side seemed to afford a better means of livelihood than could be obtained through a direct tilling of the soil, so the people brought in breadstuffs and clothing, and exported large quantities of tar, turpentine, rosin, staves, shingles, lumber, beef, pork, and hides. The forest furnished excellent grazing, and several local names, such as "Cowpens," "Middlepen," "Cattle Creek," and "Cow Castle Swamp," indicate the early centers or suggest the importance of the live-stock industry.

Indigo was first grown about 1740, and after the bounty offered for its production by the English Government in 1750 it became an important export. East India competition and the war with the mother country caused a rapid decline in its culture, and, except for a brief period prior to the civil war, it has not been grown since. Considerable quantities of corn, wheat, and oats were raised up to about 1850. From this date up to 1865 very few oats were grown, on account of the ravages of the rust, but shortly after this the red rust-proof varieties were introduced, and in recent years a considerable acreage is sown to wheat and oats, especially in the "Red Hill" region.

For a period of ten years after the civil war much rice was planted along the stream bottoms and in swampy areas, and a yield of from 20 to 50 bushels per acre was obtained. Competition, however, with the large irrigated fields nearer the coast could not long be maintained, and the cultivation of this crop, except for home consumption, has been abandoned. Pea-vine hay has been grown during the last few years and has become an important factor in the agriculture of this section. It gives a good yield on almost every soil and is fed to all kinds of stock with good results. The quantity of sugar cane grown has not changed perceptibly during a long period of years. It grows well both on the uplands and lowlands, and enough is produced to supply the home market with sirup. The turpentine indus-

try was started on a large scale soon after the civil war and continued profitable until about 1885. Cotton was not grown to any extent until 1802. By 1850 it had become the principal crop of the area, which position it has since held.

The first sawmill was established in 1850, and was run by water, this being the power used for all the mills until about 1875. The larger part of the timber up to this date was floated down the streams to the coast. The first timber cut was pine, and it was not until about 1880 that the cypress and hardwoods of the bottom lands were cut to any extent. Besides the sawmills, there are five cotton-seed oil mills within the limits of the area surveyed. The first of these was built at Orangeburg in 1885.

CLIMATE.

The climate of the area is generally very mild and many plants adapted to a semitropical climate are found growing here. As a general rule the crops suffer more from an excess of rain than from drought, this being especially true in the southern part of the area, where the country is flat. The average rainfall for each month is a little less than 3 inches.

The first killing frost in the fall occurs usually between November 5 and 20, and the last in the spring about the middle of March.

The data in the following table, taken from the records of the Weather Bureau stations at St. Matthews, St. George, and Blackville, show the normal monthly and annual temperature and precipitation. St. Matthews lies within the area surveyed, while St. George and Blackville are to the south, near the line of Orangeburg County.

The crops in the southern part of the area are usually about ten days in advance of those in the northern part.

Normal monthly and annual temperature and precipitation.

Month.	St. Matthews.		St. George.		Blackville.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	° *F.*	*Inches.*	° *F.*	*Inches.*	° *F.*	*Inches.*
January	46.9	2.73	46.4	3.15	45.9	3.50
February	46.4	4.76	46.9	4.17	45.9	4.99
March	55.3	3.19	56.8	3.29	56.6	3.57
April	64.0	3.62	63.6	3.20	64.1	3.60
May	72.9	3.30	72.3	3.14	73.2	3.81
June	79.0	5.30	78.2	5.48	80.1	5.25
July	80.4	6.58	80.4	6.04	81.4	5.73
August	80.4	6.32	79.7	6.40	80.3	5.99
September	75.1	3.59	74.9	5.25	75.2	3.98
October	64.5	2.46	64.1	2.41	64.2	3.22
November	55.8	2.19	55.8	2.46	55.7	2.08
December	47.1	2.93	47.4	3.46	46.9	3.61
Year	64.0	46.97	63.9	48.45	64.1	49.33

PHYSIOGRAPHY AND GEOLOGY.

Orangeburg County is situated in the Atlantic Coastal Plain. In its northeastern part is found a part of the "red hill" region of the State, but this soon gives way to the "upper pine belt," which continues southward through the county.

Physiographically the area may be divided into two main parts, the larger consisting of the flat lowlands and the smaller of the rolling country to the northward. The town of Orangeburg, with an elevation of 259 feet, lies nearly upon the boundary line, and from this place the line of division extends in a northeast direction. The lowlands are occupied principally by two types of soil, the Norfolk sandy loam and Portsmouth sandy loam.

Theu pland country assumes its rolling character slowly and attains its greatest elevation a little to the south of St. Matthews. As a rule the subsoil of this part of the area consists of a red clay, though directly to the north of Orangeburg the Norfolk sandy loam—a type with a yellow subsoil—is typically developed. The region to the east and north of St. Matthews is a spur of what is known in the State as the "red hill" region. The prevailing soil type is the Orangeburg sandy loam, which is considered the most productive in the area.

To the northwest of St. Matthews a portion of the "sand hill" region of the State is included within the area. This extends in a broad plateau and terminates abruptly in steep bluffs along the Congaree River. The sand is coarse and unproductive.

The drainage of the northern and eastern parts of the area is by smaller creeks directly into the Congaree and Santee rivers. A divide extends from Orangeburg to St. Matthews nearly along the lines of the Southern Railway. To the westward of this divide the streams flow into the Edisto River, while those to the eastward find outlet through the Four Hole and Half Way swamps. A number of the streams have sufficient fall to be utilized in the running of grist and saw mills. The Santee and Congaree rivers are navigable to small steamers during the greater part of the year. The rivers are bordered by a strip of lowland which averages about half a mile in width.

In the northern part of the area well water is obtained at a depth of from 30 to 70 feet, while springs are common in the hillsides. In the lowlands the water level is usually from 6 to 15 feet below the surface. Artesian wells have been sunk at Bowman and Branchville, and a good supply of water obtained at a depth of from 150 to 200 feet.

The materials forming the surface of the area are all of compara-

tively recent geologic age, and consist of red and yellow sandy clays and sands belonging to the Lafayette.

In general the whole area is covered by a gray quartz sand underlain by clay. The depth of the sand varies from a few inches to many feet, as will be seen from the description of the soil types.

Small deposits of quartz and quartzite gravel occur in many parts of the yellow clays, and at a depth of several feet layers of a white kaolitic clay are often found. In many cases both the red and yellow clays present a gray mottled appearance. In others the yellow clay is underlain a foot or two below the surface by a stratum of the red. A few small outcrops of a Neocene shell limestone are also found. These, with a small quantity of a coarse ferruginous sandstone near the Congaree River, constitute the only rock outcrops in the area. Near Bowman an 8-foot stratum of lignite has been found, and it is likely that this may cover a considerable area.

SOILS.

The table below gives the names of the several soil types found in the Orangeburg area, together with the area of each type and the percentage which each is of the total area surveyed.

As will be seen in the table, the soils have been divided between nine types, including Swamp. All but one of these—the Norfolk fine sandy loam—have been mapped in other areas.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Portsmouth sandy loam	131,904	29.0	Norfolk fine sandy loam	4,480	1.0
Norfolk sandy loam	126,592	27.9	Congaree clay	2,944	.6
Norfolk sand	86,080	19.0	Sandhill	256	.1
Orangeburg sand	45,312	10.0	Total	454,080	
Swamp	40,448	8.9			
Orangeburg sandy loam	16,064	3.5			

NORFOLK SANDY LOAM.

The soil of the Norfolk sandy loam is a gray or dark-gray sand or sandy loam, ranging in depth from 9 to 18 inches. The subsoil is a yellow clay or yellow sandy clay. As the top soil is darker than that of any of the other cultivated upland types, it is locally referred to as "black lands."

A large part of this soil type occupies broad and level areas and is usually well drained, though shallow ditches are often necessary to carry off the surplus water after rains. A few areas upon which water once stood during the greater part of the year have been

drained by the open-ditch method, and are at present producing excellent crops. East of Four Hole Swamp the areas are broad and rather uniform in texture, though often dotted with small areas of Portsmouth sandy loam. West of Four Hole Swamp the type occurs as knolls and flat ridges in the Portsmouth sandy loam. Small areas are numerous in the vicinity of Bowman. They are at a lower elevation, and as a rule the sand is coarser and the depth to the clay subsoil greater than in the main type in the larger areas. The greater part of the Norfolk sandy loam occurs in the southern part of the survey, with its northern limit nearly on a line drawn from Orangeburg to Cameron. In general, this line serves to separate the high from the low country. A peculiarity of the soil in this part of the survey is its tendency to compact, a characteristic probably dependent upon the structure or relative proportions and arrangement of the different soil particles. This feature, however, is not difficult to overcome, as good drainage, together with applications of manure and thorough cultivation, will put the soil in good physical condition.

There is another phase of the Norfolk sandy loam where the soil is lighter and the subsoil less tenacious. Such an area lies within a strip 5 miles in width and 14 miles in length, running north from Orangeburg and extending about 2 miles north of St. Matthews, and smaller bodies occur elsewhere. Both the soil and subsoil contain iron concretions and pebbles, the quantity increasing as the subsoil is approached. The sand becomes coarser in the lower part of the soil section, and the presence of this material and of the concretions gives the subsoil considerable porosity and lessens its tenacity. Frequently the iron concretions in the subsoil have decomposed, giving rise to spots of red-colored soil, and in some small areas the concretions are so plentiful as to give the soil the characteristic of a gravelly loam. This phase of the type in the main occupies gently rolling uplands, and the drainage is usually good. In such locations the best bright tobacco grown in Orangeburg County is produced. In fact, the Norfolk sandy loam as a whole is the best soil in the area for the production of bright tobacco, and is so recognized by the farmers. It produces from 1,000 to 1,200 pounds per acre.

In value and crop yields this type of soil ranks next to the Orangeburg sandy loam. It possesses one advantage over the latter, since, because of its topography, it is not subject to erosion; but on the other hand, during a wet season, crops sometimes suffer from an excess of moisture. It is suited to most of the crops grown in the area. The average yield of cotton is about one-half bale per acre, of corn from 15 to 30 bushels, and of pea-vine hay from 1,500 pounds to 2 tons. Certain portions of the type are fairly well suited to truck crops. Pecan and peach trees have a thrifty growth. The Le Conte pear grows vigorously, but often suffers from blight.

Nearly all of the Norfolk sandy loam is under cultivation. Where not cultivated the main timber growth is longleaf pine, with a scattering of hardwood species. The price of the Norfolk sandy loam ranges from $15 to $30 an acre, depending upon its location and the improvements.

The following table gives the results of mechanical analyses of typical samples of this soil:

Mechanical analyses of Norfolk sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9555	1¼ miles S. of Jamison.	Gray coarse sand, 0 to 15 inches.	9.4	21.7	9.3	29.1	19.0	6.3	4.8
9559	Orangeburg	Gray sand, 0 to 13 inches.	2.9	11.9	13.7	42.5	17.7	6.8	5.2
10911	3 miles SE. of Orangeburg.	Gray sandy loam, 0 to 18 inches.	4.2	17.3	14.3	29.3	21.6	7.8	5.5
10909	1 mile NW. of Elloree.	Gray sandy loam, 0 to 9 inches.	11.5	22.4	14.2	24.4	13.7	7.3	6.5
9557	Stilton	Gray coarse sand, 0 to 10 inches.	4.6	20.1	14.1	32.5	14.1	6.2	8.6
9560	Subsoil of 9559	Yellow sandy clay, 13 to 36 inches.	3.4	11.3	10.8	26.6	14.1	7.9	24.9
10912	Subsoil of 10911	Yellow sandy clay, 18 to 36 inches.	4.2	13.0	10.3	20.5	19.1	7.1	25.8
9558	Subsoil of 9557	Yellow sandy clay, 10 to 36 inches.	3.7	13.3	10.9	23.4	12.8	7.6	28.7
9556	Subsoil of 9555	Yellow sticky sandy clay, 15 to 36 inches.	7.7	13.2	6.9	17.6	10.9	6.2	36.8
10910	Subsoil of 10909	Yellow clay, 9 to 36 inches.	7.2	13.8	7.9	13.1	7.9	7.1	43.4

PORTSMOUTH SANDY LOAM.

The first 6 inches of the Portsmouth sandy loam is a heavy dark gray or almost black sandy loam. The sand is distributed in all four grades, with a preponderance, as shown by the mechanical analyses, in the fine sand grade. Considerable organic matter is mingled with the surface soil. The second 6 inches is a light gray and often almost a white sandy loam, containing less organic matter than the top soil. The subsoil is a drab or yellowish sandy clay, mottled with iron stains, though frequently in spots it is simply a white sand.

The Portsmouth sandy loam occupies low, flat areas, and in many places is swampy and wet. It would have been more nearly correct to have classified such places as "Swamp," but owing to their frequent occurrence in small areas it was found impracticable to separate them. Water stands upon them during a great part of the year, and they become entirely dry only after a drought. The soil of this

phase is a black silt loam, rich in organic matter, containing for a depth of from 10 to 15 inches little, if any, sand. The subsoil is practically of the same character as that of the main type.

The Portsmouth sandy loam is locally known as the "bay and pine flats," the lower-lying portions being covered with a growth of bay, gum, and cypress, with a thick undergrowth, while the more elevated portions have a growth of longleaf and shortleaf pine.

In many places, especially in the southern part of the area, this type is spotted with knolls of Norfolk sandy loam, giving the surface of the country an uneven character. These knolls are elevated from 2 to 6 feet above the adjacent soil. Where the type occurs in broad and uniform areas the surface is very level. Practically all of this soil is uncultivated. Its value heretofore has been determined almost entirely by its timber growth. While the Portsmouth sandy loam is of very little agricultural value at the present time, it is one of the most important soil types of the area, since it occupies such an extensive area of undeveloped land. It is likely that within a few years a large part of it will be brought under cultivation. However, before this can be accomplished it will be necessary to introduce an extensive system of drainage. Thus far only small spots of a few acres in extent have been ditched, while there are many thousands of acres needing reclamation.

Many of the farmers consider this soil one of the most productive types of the area. They have drawn their conclusions from results obtained by draining small depressions in the other types. When this type occurs in broad flats, the soil extends only to a depth of from 4 to 6 inches, and were these flats drained it is likely they would not prove as productive as might be expected, though they would produce comparatively good yields.

In the case of nearly every large area a drainage outlet could be found within a few miles of its center. Where the type has a sandy subsoil some trouble might be experienced by the caving in of canal banks.

The Portsmouth sandy loam occurs almost entirely south of a line running east from Orangeburg. The largest areas are found in the vicinity of Fifty-eight and a short distance northeast of Rowesville.

This soil is an intermediate type between the Norfolk sandy loam and Swamp, and when it is drained both the soil and subsoil will in time assume more the character of the former. This change will be brought about by a loss of organic matter from the soil, due to cultivation, and by the oxidization of the iron in the subsoil, a process which will be hastened by its freedom from excessive moisture and exposure to air.

The Portsmouth sandy loam furnishes excellent grazing, but is used very little for such purpose. Where it has been drained cotton

has occasionally been planted, but usually suffers from rust. The use of kainit as a fertilizer has been found to prevent this to a great extent. Most of the rice grown in the area is upon this soil. It is planted in rows and cultivated, and the fields are never more than a few acres in extent. No attempt has been made at irrigation, and it is doubtful whether this method would prove profitable, though where the type occurs near the Edisto River water could be readily secured. The lands would have to be cleared and both drainage and irrigation canals constructed. It can not be considered a typical rice soil, since it contains so much sand that it would require heavy flooding to maintain the proper conditions. The expense of preparing the type for extensive rice culture would probably be too great to permit competition with the black clay prairies of the Southwest, which are by nature so much better adapted to this industry.

The following table gives the results of mechanical analyses of samples of this soil:

Mechanical analyses of Portsmouth sandy loam.

No.	Locality.	Description.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P.ct.	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*	*P.ct.*
10782	4 miles NE. of Branchville.	Heavy sand, 0 to 6 inches.	5.1	20.3	14.2	33.9	14.2	6.5	5.5
10916	1½ miles W. of Elloree.	Heavy loam, 0 to 8 inches.	4.8	13.0	7.4	14.7	11.6	20.5	27.9
10783	Subsoil of 10782	Gray sandy clay, 6 to 36 inches.	6.9	18.4	11.6	22.6	11.8	6.6	21.6
10917	Subsoil of 10916	Gray clay, 8 to 36 inches.	3.3	9.6	5.5	9.8	7.6	23.1	40.5

ORANGEBURG SAND.

The Orangeburg sand and the Orangeburg sandy loam are closely related, the main difference being in the depth of sand covering the clay subsoil. As mapped in this area, the Orangeburg sand consists of a dark-gray sand or light sandy loam, 8 to 30 inches deep, underlain by a stiff, red sandy clay. The presence of organic matter in the first 6 inches of soil makes it darker than that farther from the surface, which usually has a yellowish tinge. The subsoil often contains small pebbles and reddish iron concretions, and in some cases these may have worked their way up into the soil. The typical depth of the sandy loam is about 15 inches. The sand varies from medium to coarse in texture and consists of rounded grains. Where the soil has not been properly cultivated and such crops planted as add no vege-

table matter, the soil, except in land just cleared, shows very little difference in color at different depths.

The Orangeburg sand occupies no broad areas, but is well distributed over the entire rolling portion of the survey. In the Orangeburg sandy loam region to the east and northeast of St. Matthews it is usually found occupying rolling upland and ridges between stream courses. It is also found on hillsides along some of the stream courses. In the less rolling part of the area it occurs in connection with the Norfolk sandy loam, and often a single field will show several alternations between these two types. The upland position of this soil generally insures good drainage.

The Orangeburg sand is considered a good type of land for general farming. It was not found practicable in mapping it to distinguish between those lands having only 15 inches of sandy loam and those having 30 inches, and the value of the type has a wide range, decreasing as the depth of the sand increases. The texture of the sand also affects the crop yields. In certain local spots the sandy loam becomes finer and more compact, and there it is better able to hold moisture and fertilizers.

The average crop yields, where the soil is typical, are as follows: Cotton, one-half bale; corn, 12 to 16 bushels, and oats, 20 to 25 bushels per acre. Cotton and corn are the two principal crops. Sweet potatoes, peanuts, and tobacco are sometimes grown. The land sells for from $15 to $30 an acre. The timber growth consists of longleaf pine and hardwoods.

The following table gives the results of mechanical analyses of typical samples of this soil:

Mechanical analyses of Orangeburg sand.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9575	1¼ miles SE. of St. Matthews.	Gray sand, 0 to 17 inches	4.0	11.8	9.6	34.0	30.4	5.9	3.8
9573	2 miles N. of St. Matthews.	Gray sand, 0 to 15 inches	5.8	17.2	6.4	23.6	36.0	5.8	4.7
9571	2½ miles SW. of Jamison.	Gray coarse sand, 0 to 14 inches.	7.0	19.8	6.9	24.9	27.5	7.0	6.8
9576	Subsoil of 9575	Red sandy clay, 17 to 36 inches.	2.1	6.4	5.4	21.5	24.8	13.1	26.7
9574	Subsoil of 9573	Red sandy clay, 15 to 36 inches.	3.9	14.8	5.4	18.2	23.3	6.0	28.4
9572	Subsoil of 9571	Red sandy clay, 14 to 36 inches.	4.3	12.9	4.9	12.4	19.9	7.1	38.4

ORANGEBURG SANDY LOAM.

The soil of the Orangeburg sandy loam consists of a dark-gray sand or light sandy loam from 0 to 8 inches deep, with an average depth of 5 inches. The sand is medium to coarse in texture and the grains rounded. When the soil is shallow it often has a reddish tinge, due to mixture with the subsoil. The subsoil to a depth of 3 feet or more is a stiff, dark-red sandy clay, through which are scattered a few small pebbles and iron concretions. Bands of these may frequently be seen in road cuts or gullies.

The Orangeburg sandy loam is the principal soil of a large tract to the east and northeast of St. Matthews, known locally as the "red hill" region. This area is large and uniform, but smaller areas are found associated with many of the other upland types. These smaller areas usually occupy steep hillsides or are near stream courses where the sand has been washed off, leaving the clay either exposed or covered with but a few inches of sandy loam. The topography of the tract first referred to is moderately rolling, and the drainage is good. This type is the best cotton land in the county, as well as being the best for all general farming crops except tobacco. Crops generally do well upon it either in a wet or dry year. In a dry season the clay subsoil holds sufficient moisture to carry over the crop, and in a wet season the rolling character of the surface prevents the soil from becoming water-logged, as it often does in the lower country. The sandy surface soil also allows the type to be worked in a minimum lapse of time after rains. Clay having a covering of from 4 to 5 inches of the lighter material is considered the most valuable for crop production.

As a rule terracing on this type is not necessary, but in certain cases erosive action has removed a large part of the sand from the hillsides and left bare clay fields streaked with gullies resembling those of the Cecil clay regions found in the Piedmont. It takes years again to fit these fields for cultivation, and a little careful terracing at the right time would have saved much loss.

Cotton on this type will average from one-half to three-fourths of a bale per acre, and when well fertilized and properly cultivated certain extensive tracts will produce a bale per acre. Corn produces from 20 to 30 bushels per acre on much of the land, but will not average over 15 bushels. Oats will average 20 to 25 bushels per acre, and in a good year will produce as high as 40 bushels. As a rule it pays to fertilize these lands heavily. Farms in good state of cultivation sell for $25 to $40 per acre.

The characteristic growth of timber on this type is shortleaf pine, dogwood, hickory, and several varieties of oak, with a sprinkling of longleaf pine. This combination is not found in any of the other types. The second growth of pine is usually of the shortleaf variety.

The following table gives the results of mechanical analyses of typical samples of this type of soil:

Mechanical analyses of Orangeburg sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9569	4 miles N. of Orangeburg.	Gray coarse sand, 0 to 6 inches.	6.9	18.0	8.9	25.3	27.0	8.1	5.4
9567	3 miles NW. of Cameron.	Gray sand, 0 to 6 inches..	3.0	8.2	4.2	29.5	41.6	7.4	6.0
9565	½ mile SW. of Singletons.	Gray sand, 0 to 5 inches..	7.1	11.0	5.6	30.3	31.4	7.7	6.2
9566	Subsoil of 9565.....	Red sandy clay, 5 to 36 inches.	4.3	9.3	4.2	19.8	23.5	7.4	31.2
9568	Subsoil of 9567.....	Red sandy clay, 6 to 36 inches.	2.6	5.2	2.9	16.4	25.5	10.8	36.6
9570	Subsoil of 9569.....	Red sandy clay, 6 to 36 inches.	4.4	10.9	5.5	15.3	16.5	5.5	41.8

CONGAREE CLAY.

The soil of the Congaree clay consists of 3 feet or more of light-brown or chocolate-colored clay, containing some very fine sand. From 8 to 36 inches the material is a little lighter in color than the top soil, and occasionally a thin seam of very fine sand is found. The terraces contain a little more sand than the low-lying areas, and often small particles of mica, brought down from the Piedmont, are found scattered through the soil. The soil in the low-lying areas consists of about 10 inches of heavy brown clay, underlain by a brownish yellow subsoil of practically the same material. This phase of the type, which is inclosed between the river terrace and bluffs, forms a kind of basin, and water stands upon it during a wet season or after an inundation. Where it has been ditched or where there is some small stream to give an outlet into the river, it drains very rapidly, but there are many small sloughs or ponds where the water remains a large part of the year. These places were at one time covered by a dense growth of cypress, most of which now has been cut. The timber growth of the remainder of the type is principally gum, hickory, cottonwood, and sycamore, with some pine and cypress. The second growth is largely sycamore and cottonwood.

The larger part of the cultivated area of this soil lies in a narrow strip along the river. The overflows, which occur quite frequently and seem to have been more numerous of late years, have caused

general farming to be abandoned because of the uncertainty of a crop. A large part of the cleared area of this soil type is covered by a rank growth of Bermuda grass, to which the soil seems well adapted and at present it could be utilized most profitably for stock raising. Two crops of hay are always secured and often three are cut in a season. Corn sometimes yields from 40 to 50 bushels per acre and oats from 50 to 60 bushels.

The following table gives the results of mechanical analyses of this soil:

Mechanical analyses of Congaree clay.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Pc. t.*	*P. ct.*
9579	½ mile E. of Beaver Creek.	Brown loam, 0 to 14 inches.	0.1	0.2	0.3	5.4	17.3	51.5	25.2
9581	1 mile E. of Southern Rwy. bridge.	Brown clay, 0 to 12 inches.	.1	.3	.4	3.0	11.1	48.9	36.2
9577	1 mile E. of Southern Rwy. bridge.	Brown clay, 0 to 8 inches.	.1	.3	.5	2.0	2.2	50.7	44.2
9582	Subsoil of 9581	Light-brown clay, 12 to 36 inches.	.0	.1	.3	3.4	10.7	49.6	35.7
9580	Subsoil of 9579	Brown clay, 14 to 36 inches.	.1	.4	.1	1.9	8.9	51.8	36.4
9578	Subsoil of 9577	Brown clay, 8 to 36 inches.	.0	.6	1.2	4.5	3.9	47.3	42.7

NORFOLK FINE SANDY LOAM.

The Norfolk fine sandy loam consists of about 5 inches of fine gray loamy sand, underlain by about 10 inches of yellow fine sand containing very little organic matter, which rests upon a subsoil of yellow sandy clay, the sand in both soil and subsoil being of the finer grades. Occasionally small spots are found where the yellow sand which underlies the first 6 inches of soil extends to a depth of 3 feet, becoming less loamy as the depth increases until at a depth of 30 inches it is almost a pure sand.

The Norfolk fine sandy loam occupies a relatively small proportion of the survey. It occurs in a few comparatively broad and uniform areas about 5 miles north of Bowman. The surface is level, but the drainage is good. Almost all of the type is under cultivation and very little of it has any timber growth.

This type is closely related to the Norfolk sandy loam, the main differences being in the texture of the sand and in the agricultural value. The sand of the Norfolk fine sandy loam is finer than the

Norfolk sandy loam and the crop yields are lower. It is said to be better adapted to corn than to cotton, yielding from 15 to 20 bushels of corn and from one-fourth to one-half bale of cotton per acre.

The following table gives the results of mechanical analyses of typical samples of this soil:

Mechanical analyses of Norfolk fine sandy loam.

No.	Locality.	Description.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10852	5½ miles N. of Bowman.	Fine sandy loam, 0 to 16 inches.	1.3	5.7	6.1	60.5	15.1	7.7	3.6
10854	3½ miles NE. of Bowman.	Fine sandy loam, 0 to 18 inches.	1.5	8.3	8.8	56.8	12.0	7.7	4.9
10853	Subsoil of 10852.....	Yellow sandy clay, 16 to 36 inches.	2.9	6.1	5.1	47.5	10.9	6.6	20.9
10855	Subsoil of 10854.....	Yellow sandy clay, 18 to 36 inches.	1.2	6.2	6.4	42.1	9.2	9.4	25.5

NORFOLK SAND.

Norfolk sand consists of 3 feet or more of sand, the greater proportion being nearly uniformly distributed in the coarse, medium, and fine grades. The first 6 inches of the surface soil is a gray, loamy sand, a little darker in color than the subsoil, which is of a reddish-brown or yellowish color. This variation in the color of the subsoil is influenced by the topography. The type occupies broad table-lands and comparatively steep rolling areas. Where it occupies the lowest of the table-lands it usually occurs in spots or small areas, and here the subsoil is yellowish, while in the more elevated and rolling portions it is generally reddish brown, though the yellow subsoil is also often encountered in such positions.

The Norfolk sand is also found in all parts of the area as a washed deposit along stream courses. This phase is always yellowish in color and usually quite coarse in texture, although when surrounded by the Norfolk sandy loam the texture may vary from medium to fine. In the southern part of the area, in addition to the deposits found along the streams, there are usually ridges of Norfolk sand surrounding certain large swamplike depressions in the Portsmouth sandy loam, locally known as "bays." These ridges are from 6 to 15 feet above the adjacent soil, and are composed of yellow sand.

A series of sandy hills, varying from 2 to 4 miles in width, border

the bottoms along the Congaree and Santee rivers and often approach close to the rivers themselves, forming a series of bluffs which are locally known as the "River Hills." Among these hills, which become less rolling as the southern part of the area is approached, are numerous V-shaped valleys that have been eroded by the streams.

It is very seldom that the red clay, which underlies by far the greater proportion of this type, is exposed on the slopes, but occasionally it comes near enough to the surface—that is, within 3 feet—to give rise to small areas of Orangeburg sand. These areas are usually found in the cultivated fields, which are subject to greater erosion than the timbered areas. And it is through the washing away of the overlying sand that this difference in soil type arises.

The small areas of Norfolk sand which occur in the south and southwestern parts of the survey are underlain by a yellow clay at a comparatively slight depth. Along the "River Hills" it may be 25 or even 60 feet to the red clay.

From the description of the "River Hills" it would seem as if they should be classed as Sandhill, but the sand is not so coarse as that of the true Sandhill and does not possess its characteristic looseness.

On account of the loose and leachy character of the Norfolk sand it is of little value for general farming. It is, however, well adapted to fruit and truck crops and might be utilized advantageously for these products in the present area as it has been in other sections of the Atlantic seaboard.

The application of commercial fertilizers on the Norfolk sand has not proved very profitable. In a rainy season very little effect is seen even from a heavy application, as the materials go into solution and leach out before the plant is ready to take them up. When commercial fertilizer is used, it should be applied in small quantities at different periods of the growing season. In preparing this soil for cotton the fertilizers should be put on top of the ground in the middle of the old rows instead of making a new furrow, as is usually done. The undisturbed soil is more closely packed and has a greater tendency to hold moisture. What this soil needs most, however, is organic matter, and the best fertilizer is barnyard manure. The timber growth on the Norfolk sand is longleaf pine and scrub oak. There is less of the Norfolk sand cultivated than of any of the other types in the area except the Portsmouth sandy loam. The crop yields are so small that very little profit, if any, is realized. This type of soil may be bought for from $2 to $5 per acre.

The following table gives the results of mechanical analyses of typical samples of this soil:

Mechanical analyses of Norfolk sand.

No.	Locality.	Description.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
11180	1 mile E. of Elloree	Coarse sand, 0 to 8 inches	5.2	24.7	20.5	30.7	9.5	5.4	3.6
10913	2½ miles SE. of Branchville.	Dark-gray coarse sand, 0 to 6 inches.	8.3	33.1	17.1	21.2	9.7	4.0	5.8
10915	Subsoil of 11180	Yellow coarse sand, 8 to 36 inches.	4.9	20.7	18.5	34.8	10.2	5.6	5.2
10914	Subsoil of 10913	Yellow coarse sand, 6 to 36 inches.	12.5	29.6	14.4	18.7	9.3	5.1	10.4

SWAMP.

The term Swamp is applied to a soil that is too low and too wet to be of any agricultural value, except for rice growing. This type occurs as low, flat, and poorly drained areas along stream courses, the largest areas being found along the Santee River and Four Hole Swamp. It borders all of the smaller streams, and here many areas were too narrow to be represented on a map of the scale used. The soils grouped as Swamp have not been classified according to texture. They may be sand, clay, or silt, but, from the little examination possible, the material is usually a mixture of sand and yellow or gray clay.

The principal growth on the Swamp consists of water-loving grasses and trees, and only occasionally is it cultivated. A few fields, 1 or 2 acres in extent, are used for rice, and this at present is its sole agricultural use. With proper drainage more of this type could be brought under cultivation, but this will not be done for many years to come, as there is much land of other types that can be put in cultivable condition at less cost.

SANDHILL.

In the extreme southern part of the area a peculiar topographic feature is found, locally known as "Sandy Island." It consists of a mound rising to an elevation of from 10 to 12 feet above the adjacent soil and having an extent of a few hundred acres. It is surrounded by the Portsmouth sandy loam and Swamp. The soil is of a uniformly coarse textured sand to a depth of 3 feet or more. In

the first 6 inches the color is slightly darkened by the presence of a very small proportion of organic matter; below this the material is approximately white. This one area is the only true Sandhill soil found in this survey. It has a slightly rolling topography and possesses some of the characteristics of a sand dune, and only here and there occurs any vegetation, generally a small bush, scrub oak, or pine.

The following table gives the results of mechanical analyses of soil and subsoil of this type:

Mechanical analyses of Sandhill.

No.	Locality.	Description.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
10920	3½ miles SE. of Branchville.	Light-gray sand, 0 to 5 inches.	5.4	42.0	24.8	24.7	1.6	0.7	0.6
10921	Subsoil of 10920	White sand, 5 to 36 inches.	11.8	37.0	27.8	21.4	1.2	.4	.1

AGRICULTURAL CONDITIONS.

The greater proportion of the more productive soil of Orangeburg County is at present under cultivation. Considerable areas once under cultivation have been abandoned for virgin soil, but there yet remain thousands of acres of soil as fertile as any under cultivation, as well as large areas covered by forests of pine, cypress, and hardwood, less desirable for crops now generally grown.

At one time, when virgin lands were cheap and plentiful, the farmers could afford to cultivate one field until the soil was exhausted, then abandon it and clear up new land for cultivation. Now that the country has become more thickly settled and land values have increased it is no longer practicable to follow the loose, wasteful methods of yesterday. As a result the farming practices are gradually improving and a more economical and intelligent system is being introduced. More attention is being given to the use of fertilizers and the rotation of crops in the effort to maintain the productivity of the soils. It is the general opinion that where careful attention has been given to these matters much larger crop yields are being realized by the farmers.

The farms vary in size from 50 to several thousand acres. The larger farms are gradually being cut up into smaller ones, and at present the average size of farm is probably between 75 and 100 acres. Probably 75 per cent of the area in small farms is under cul-

tivation, while in many of the larger ones not more than 50 per cent is cultivated.

Considering only the more productive types of soil, land values have easily doubled during the last ten years. At the beginning of this period prices ranged from $8 to $20 an acre. Good land now brings $15 to $40 an acre, and some of the best improved farms near the towns are held as high as $50 an acre. In the northern, eastern, and southern parts of the area, where the broad tracts of the Norfolk sand and the Portsmouth sandy loam lie, wild land can still be bought for from $2 to $5 an acre.

The leading crops are produced largely under the share system, though in some cases land is rented for a definite quantity of cotton, usually from 30 to 40 pounds lint cotton per acre, depending upon the productivity of the soil. Very little, if any, land is rented for cash. Under the share system the landowner furnishes the land, work animals, implements, fertilizers, and seed; in other words, everything that is necessary to grow a crop except the labor. The tenant cultivates and harvests the crop, and in return for his year's labor receives one-half the products, usually cotton and corn. In allotting the land on shares, 30 acres is allowed to each horse. From 20 to 25 acres of this is commonly planted to cotton and the remaining 5 or 10 acres to corn. In most cases where the land is cultivated on the share system, the landowner furnishes the tenant supplies during the year, for which certain interest is charged and a mortgage or lien taken on the tenant's half of the crop as security.

Many of the tenants who pay a certain amount of cotton per acre are furnished their yearly supplies by the merchants of the near-by towns. In this case the landowner receives his rent first and the merchant is paid out of the remainder of the crop, on which he holds a mortgage security.

Many of the farmers cultivate their land with labor hired either by the year, month, or day. The wages range from $6 to $7 a month and board, or $9 to $10 without board. In addition to this many farmers allow the hands hired by the year or month 2 or 3 acres of land for their own use. The hoeing of the cotton is usually contracted for by the acre, the price ranging from 35 to 45 cents. The rate paid for picking cotton is from 40 to 50 cents a hundred pounds of seed cotton. The cotton-picking time is considered by the negroes as their happiest and most prosperous season, as the end of each week finds them with money in their pockets. A good hand can pick from 200 to 225 pounds a day. All the negro children, half-grown and upward, who are unable to do other farm work, are found in the cotton fields during the picking season. They can each pick from 50 to 100 pounds a day. Often a single family picks from 500 to 800 pounds a day.

The owners of the larger plantations gin their own cotton and occasionally do a little ginning for neighboring farmers, for which $1 a bale is the usual charge. The cotton-oil mills, which are situated in the towns and have the latest improved machinery, gin cotton for 50 or 75 cents a bale.

The low price of cotton in 1897 and for several years prior thereto compelled the farmers of the county to look for some other money crop, along with cotton. In this endeavor tobacco was introduced into the area. The farmers, who were entirely inexperienced, employed experienced tobacco men to instruct them in the methods of growing and curing the tobacco. These instructors were employed on a salary, one man having general supervision over several farms. The first year between 250 and 300 acres were planted in the county, and in general the results were satisfactory. Enough profit was made to pay the salaries of the tobacco experts employed and to cover the expense of building proper barns in addition to the expenses ordinarily incident to cultivation.

An advance in the price of cotton soon after the introduction of tobacco caused a decrease in tobacco acreage, though each year since its introduction it has been planted to some extent. Some of the growers realize handsome profits, while others have failed, owing, for the most part, to poor management. The exceptionally high price of cotton the present year (1904) and the low price of tobacco will likely cause a further reduction in the acreage of tobacco, though the county has been benefited more by the introduction of the industry than many now realize. Whereas cotton formed the sole money crop prior to the introduction of tobacco, the farmers over a large part of the county can now change from one crop to the other according as the prices are high or low, or better still, they may plant both and thus guard against loss due to sudden fall in the price of one or the other product.

The highest grades of bright tobacco are produced more uniformly on the rolling and well-drained Norfolk sandy loam, a type which has been found specially adapted to this crop in most of the other bright-tobacco districts.

Orangeburg County ranks first in the State in the production of cotton. According to the last census the cotton crop of the county in 1899 was 62,309 bales, the average yield being one-half bale per acre.

Very little attention has been given to the raising of live stock, though there are lands that could be utilized more profitably for this purpose than in any other way. There are a few farmers who raise enough meat and corn for home use. A great many, however, do not produce enough of these products to carry them through the winter, while others purchase almost all their home supplies.

The number of live stock in the area has not materially changed in the last ten years, though some of the townships bordering the rivers and those including large areas of the Portsmouth sandy loam show a slight increase in the number of cattle and there has been a little more attention given to cattle raising in these areas in recent years.

Bermuda grass covers a large proportion of the bottom lands and is used for hay and also for grazing purposes. This grass makes a vigorous growth and is often cut three times during a season. There are areas of the Norfolk sand bordering the Santee and Congaree rivers that support a good growth of Japan clover and these would furnish fair grazing. There are also broad areas of the Portsmouth sandy loam that offer excellent grazing, but it is very seldom that a pasture is found on either of these types. In all there are many thousand acres of land now lying idle that would furnish good grazing during six or seven months and in some places, where there is a good growth of cane, during the entire year.

Pea-vine hay can be used to a large extent for winter feed, besides the hay cut from the wild grasses. The importance of cowpeas as a forage crop is becoming more widely recognized. After grain is harvested the stubble fields are sown broadcast in peas, which are cut for hay early in the fall, making from 1 to 2 tons per acre. It is usually worth in the early winter from $8 to $10 a ton and in late winter from $12 to $18 a ton, thus giving a profit equally as great and often greater than the preceding grain crop and at the same time increasing the productiveness of the soil. It would seem from such advantages that the raising of cattle could be largely extended and made a very profitable industry.

Although some of the soils, especially the Norfolk sand and the Norfolk sandy loam, are well adapted to the production of fruit and truck, only small quantities of asparagus, green peas, strawberries, and peaches are grown and shipped to the northern markets. Some extension in the fruit and truck industries is taking place, however, and there seems no good reason why these interests should not become of considerable importance. Some plantings of asparagus made in recent years have proved particularly profitable.

In general the farming class of Orangeburg County is prosperous, though the conditions vary considerably in different parts of the county and on different soil types. The most valuable and best kept plantations are usually found in the Norfolk sandy loam, the Orangeburg sand, and the Orangeburg sandy loam. In the central, southern, and southeastern parts of the county, which are low and flat, a large percentage of the farming is done by negroes and the progress has been slower.

The greater part of the timber has been cut, though there still remain some pine forests and a few good tracts of cypress. The cypress grows in swampy places where it is very difficult to get it out. The most of the sawmills in operation are in the southern part of the county, the timber being cut from the Portsmouth sandy loam.

The area is traversed by the Southern and Atlantic Coast Line railroads. There is also a narrow gauge road about 12 miles long which connects the towns of Branchville and Bowman. The Southern and the Atlantic Coast Line intersect at Orangeburg, the county seat, which is situated in the western part of the survey, and is the only town in the area that has any railroad competition. The Southern Railway crosses the extreme southern part of the area through Branchville, and also extends north almost parallel to the western edge of the map to Orangeburg, from which place it turns eastward and crosses the northern corner of the area. The Atlantic Coast Line crosses the area a little north of a central point on the map, and also has a branch line running through the central eastern portion.

The nearest cities to the area are Charleston and Columbia, S. C., and Augusta, Ga. The Southern Railway furnishes direct transportation to all these, while the Atlantic Coast Line reaches the latter. These cities are within a few hours' run of Orangeburg. Most of the farmers live within a reasonable distance of a railroad, the most distant point being about 10 miles. Nearly all of the cotton is shipped to Charleston, S. C., Savannah, Ga., and Wilmington, N. C.

The county roads in the area, as a general rule, are rather poor, being usually deep with sand where they cross areas of the Norfolk sand and the Norfolk sandy loam. The roads are now being improved by convict labor. The soils of the area are either largely sand or clay, which when mixed make excellent road material at a small cost.

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BUREAU OF SOILS
MILTON WHITNEY, CHIEF

SOIL MAP

SOUTH CAROLINA
ORANGEBURG SHEET

SOIL PROFILE
(3 feet deep)

Norfolk sand
S

Orangeburg sand
Ssc
Csc

Norfolk sandy loam
Ssc
Csc

Norfolk fine sandy loam
Ssc
Sfsc
Csc

Congaree clay
C
C

Orangeburg sandy loam
Ssc
Csc

Portsmouth sandy loam
Ssc
Ssc
Csc

Sandhill
S
S

LEGEND
S Sand
Ssc Sandy loam
Csc Clay and sand
Sfsc Fine sandy loam
C Clay

LEGEND

Ns Norfolk sand
Os Orangeburg sand
Nl Norfolk sandy loam
Nfs Norfolk fine sandy loam
Cc Congaree clay
Ol Orangeburg sandy loam
Ps Portsmouth sandy loam
Sh Sandhill
S Swamp

Soils surveyed by
Frank Bennett and party
1904

Scale 1 inch=1 mile

ANDREW B. GRAHAM CO. LITHOGRAPHERS WASHINGTON D.C.

Field Operations
Bureau of soils
1904